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5G Promises to Transform Marine Industries

New maritime 5G network set to generate 100 million yuan in revenue by the end of the 2022

In Ningde, Fujian Province, China Mobile and Huawei have built a maritime 5G network that stretches 50 km out to sea and is supporting maritime management fishing, tourism and energy applications, as well as consumer services. The advanced network, which uses a mixture of frequency bands, is designed to provide high-speed 5G connectivity to thousands of islands and vessels along the coastline of Fujian.







New maritime 5G network set to generate 100 million yuan in revenue by the end of the 2022

CASE STUDY LEAD: CHINA MOBILE AND HUAWEI CO. LTD.

+ CHALLENGE

 Many people work offshore in the fishing, tourism and energy sectors or for public agencies involved in environmental protection and maritime management. But providing extensive mobile coverage at sea tends to be both difficult and expensive. Low-earth orbit (LEO) satellite communications cost far more than terrestrial networks and are subject to higher latency. Some ships use slow transmission speed VHF (very high frequency) connectivity for alarm reporting and short-distance communications, but this technology doesn't have the bandwidth to support video and frequent communication interactions.

+ SOLUTION

 In Ningde, China Mobile and Huawei have built a showcase 5G marine network to provide coverage up to


50 km offshore. The network employs tall radio masts transmitting over a mixture of frequency bands, supplemented by network technologies and techniques designed to optimise coverage at sea. The two companies are using 700 MHz spectrum for the foundation network, supplemented by 5G services at 2.6 GHz and 4.9 GHz for greater capacity. The new 5G network is providing connectivity to maritime workers, tourists and island residents, as well as enabling the continuous monitoring of fish farms, fishing boats and wind turbines.

+ IMPACT & STATISTICS

 China Mobile Fujian reports the new network has attracted 450,000 customers in its first year of operation, contributing 17.28 million yuan (€2.39 million) of new


service revenue. Furthermore, 650,000 4G users in the region have upgraded their connections to 5G, generating revenue of 31.2 million yuan. The operator expects the revenue of the maritime network project to reach 100 million yuan by the end of the 2022.

+ WIDER IMPLICATIONS

 The showcase 5G network in Ningde is serving as a template for other maritime networks to meet the growing demand for connectivity at sea. Similar solutions have since been implemented in eight coastal provinces and cities in China. In China alone, there are about five million coastal fishermen engaged in aquaculture and fishing. Moreover, there are 90,000 small fishing boats active within 50 km of China's coasts. Specialist 5G networks can provide this enormous industry with the connectivity it needs, while also helping to regulate

recreational fishing. In the energy sector, 5G could be used to bring connectivity to China's 14,000 offshore wind turbines, which are on average 22 km offshore. Furthermore, 5G could be the basis for an integrated marine emergency command information system to support rescue operations.

+ STAKEHOLDERS

 China Mobile /Huawei technology co. Ltd

SOURCES & FURTHER INFORMATION



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New maritime 5G network set to generate 100 million yuan in revenue by the end of the 2022

Fishing, coastal tourism, offshore wind turbines, the coastguard and marine protection agencies could all benefit from high quality cellular connectivity. But providing extensive mobile coverage at sea tends to be both difficult and expensive.

Low-earth orbit (LEO) satellite communications cost far more than terrestrial networks and are subject to higher latency. Some ships use slow transmission speed VHF (very high frequency) connectivity for alarm reporting and short-distance communications, but this technology doesn't have the bandwidth to support video and frequent communication interactions.

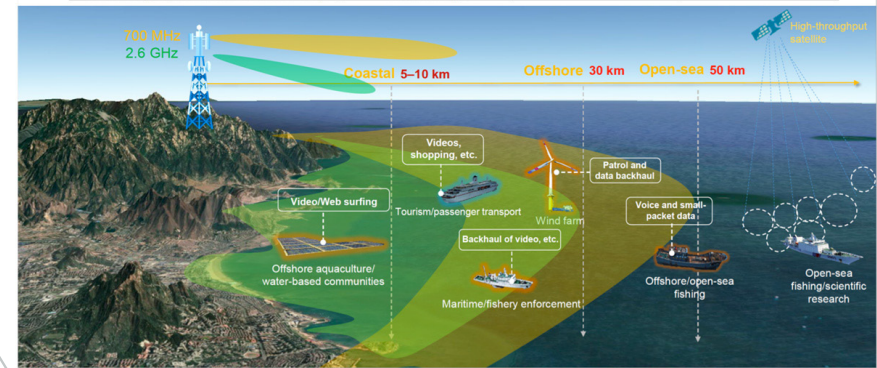
A new 5G-based solution, developed by China Mobile and Huawei, promises to resolve the problems associated

with traditional maritime communications. Using multiple frequency bands, the solution employs tall radio masts to provide high-speed connectivity in coastal and offshore areas over distances of up to 100km.

In Ningde, Fujian Province, China Mobile and Huawei have built a pilot maritime 5G network that stretches 50 km out to sea and is supporting law enforcement, fishing, tourism and energy applications, as well as consumer services. China Mobile Fujian reports the new network has attracted 450,000 customers in its first year, contributing 17.28 million yuan (€2.39 million) of new service revenue. Furthermore, 650,000 4G users in the region have upgraded their connections to 5G, generating revenue of 31.2 million yuan. The operator expects the revenue of the maritime network project to reach 100 million yuan by the end of the 2022.

Target 5G Sea Network: T+F SUL for Coastal, Offshore, and Open-Sea Areas

(DL 100 Mbps, UL 8 Mbps) @ 95% RSRP > -105 dBm	(DL 100 Mbps, UL 3 Mbps) @ 95% RSRP > -110 dBm	(UL 1 Mbps @ 95%) RSRP > -115 dBm	Best Effort
5GtoC/5GtoH: coverage of densely populated areas such as floating fish farms and fishing villages Good network quality assurance for law enforcement ships	5GtoC: linear coverage of sea routes, partial network quality assurance for law enforcement ships	5GtoC: continuous coverage, basic call functions	5GtoC: best-effort, no standard requirements



China Mobile and Huawei are using 700 MHz spectrum for the foundation network, supplemented by 5G services at 2.6 GHz and 4.9 GHz for greater capacity, and satellite connectivity. "Our multi-band 3D coordinated network provides the same speed and experience as terrestrial 5G networks," says Wu Xiaoxiong, network engineer of

China Mobile Fujian. "Hierarchical coverage was provided based on different site heights to coastal, offshore, and open sea areas, and different bands for different service scenarios to help adapt 5G networks to marine service characteristics."



Supporting a wide range of applications

Maritime law enforcement agencies are using the 5G network to capture real-time video feeds from ships out at sea, allowing for around-the-clock surveillance which is much more efficient than irregular inspections. The network is also being used for continuous surveillance of the more than 2,000 uninhabited islands in Fujian, as well as to monitor vessels in real time. An artificial intelligence (AI) system automatically counts and identifies ships, thereby monitoring the 20,000 marine fishing boats in Fujian.

The pilot solution also supports a surveillance system for floating fish farms, which can detect unauthorised intrusions or accidents, such as someone falling into the sea, and sound an alarm. The same approach is being used on the Gulei peninsular to detect people in dangerous coastal areas, trigger alarms, and persuade the individuals to exit the area.

Meanwhile local tourism bureaus are using the new 5G network to live stream footage to promote scenic spots, such as Xiapu and Donghu. The high-speed connectivity can also be used by island residents and visitors, rejuvenating the local economy. On Meizhou Island, Putian, 5G is

supporting ticket purchases using digital ID cards, a smart bus station, the virtual reality MazuCulture Exhibition Hall, and connected vehicles.

Many of the 200,000 workers stationed perennially on the floating fish farms in Ningde are also making extensive use of the 5G network. These aquaculture workers use the connectivity for e-commerce, live streaming and to watch video entertainment. For example, fishermen can live stream footage of their catch to potential customers onshore. Huawei envisions that mobile operators will work with multi-channel TV networks (such as TikTok and Taobao) to build live TV studios on the fish

farms. The resulting revenues would be shared between the mobile operators, in return for providing network assurance, and the TV network introducing live streaming resources.

In the energy sector, wind farms can use 5G to capture video footage from drones inspecting offshore turbines and their blades, as well as providing valuable connectivity to maintenance staff. The 5G network can also be used to identify and monitor ships approaching the wind farm's foundation piles.

To provide coverage around wind farms, China Mobile has deployed booster stations on 25 meter platforms out at sea. These

stations connect with 5G receivers mounted on the turbines, which then provide coverage inside the structure. This system can be used to collect data from wireless vibration sensors and audio receivers enabling predictive maintenance. Similarly, video cameras can be used to monitor the bolts between each section of the tower. The connectivity can also be used to activate an anti-typhoon mode to minimise the impact of a severe storm on the turbines.



5G brings greater coverage and capacity at lower cost

The 5G network deployed by China Mobile and Huawei is designed to overcome the shortcomings of existing alternatives. China Mobile says the per unit cost of carrying data traffic by 5G is 1% of the cost of using satellite connectivity. It estimates that in offshore areas in Ningde, 100 5G cell sites could support capacity of 485 Gbps, compared with the 50 Gbps from satellite infrastructure. The new 5G network also offers much better offshore coverage than would be possible with 4G, according to China Mobile. The operator’s tests have found that the 4G coverage beyond 20 km is poor (see chart).

That means 4G networks are not well suited to key maritime use cases. Coastal countries have control over legal and regulatory matters, such as customs, environment, immigration or health, within their contiguous zones, which extends up to 44.5 km offshore. The patrol routes of provincial-level maritime, fishery, environmental protection, and other law enforcement ships are mainly in the contiguous zones.

To extend the base station’s coverage radius, Huawei has optimised the parameters in the wireless protocol layer. As a result, Huawei says it has been able to extend coverage to 100 km for networks using frequency division duplex (FDD) and 60 km for networks using time division duplex (TDD).

The new network also uses “a calibrated 5G maritime propagation mode” to improve coverage at sea. “A segment-based method was proposed for marine radio propagation with the impact of earth curvature, sea reflection, and rain and fog weather fully taken into account,” explains Peng Jun, director of 5G industry at Huawei. “Based on the model, the site height was researched for meeting the coverage distance of 10 km, 30 km, and 50 km, which provides planning guidance for maritime wireless signal coverage.”

Huawei says it is also using carrier aggregation technology to improve base station coverage, together with a large inter-site distance and high-gain antennas to make the network better suited to maritime service characteristics. China Mobile and Huawei have summarised the standards for marine network coverage planning and construction in their **5G Smart Ocean** white paper.

4G coverage in Beihai, Qinzhou, and Fangchenggang, Guangxi

Distance (km)	Network Quality	HD Voice	2G Call
0–10	Good	Good	Good
10–20	Fair	Fair	Fair
20–30	Poor	Poor	Poor
30–40	No signal	No signal	No signal
40–50	No signal	No signal	No signal



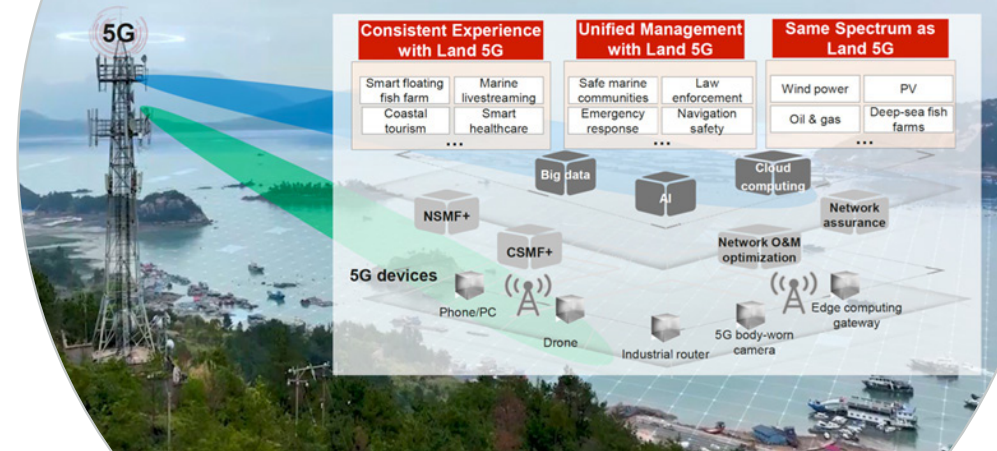
A blueprint for **better offshore connectivity**

The showcase 5G network in Ningde is serving as a template for other maritime networks to meet the growing demand for connectivity at sea. The network construction standards and related “5G smart ocean” applications have already been implemented in eight coastal provinces and cities in China, including Liaoning, Shandong, Tianjin, Jiangsu, Zhejiang, Shanghai, Guangdong and Hainan Provinces.

In China alone, there are about five million coastal fishermen engaged in aquaculture and fishing, according to the 2021 China Marine Economic Statistical Bulletin. Moreover, there are 90,000 small fishing boats active within 50 km of China’s coasts. Specialist 5G networks could be used to provide this enormous industry with the connectivity it needs, while also helping to regulate recreational fishing. Interim measures for the trial management of recreational sea-fishing boats issued by Shandong, Guangdong and Fujian provinces, mandate an offshore distance limit of 9 km.

In the energy sector, there is scope to bring connectivity to many more wind turbines. Today, just 1% of China’s 14,000 offshore wind turbines, which are on average 22km offshore, are covered by 5G. With the expansion of offshore wind energy development and the upsizing of wind turbines, offshore wind farms are extending deeper into seas. Similarly, 5G could also be used to connect oil and gas rigs, as well as passenger ships in the vicinity of the coast.

5G Gbps Boosts the Digital Development of the Marine Industry



Furthermore, 5G connectivity could be the basis for an integrated marine emergency command information system that supports audio and video collaboration, and fast dispatching and remote control of unmanned vessels and drones for rescue operations. Huawei believes the maritime 5G network could enable a 5G drone to transmit 4K video images at 20 frames per second, for example, or an unmanned boat or raft could transmit 1080p video at 30 frames per second.

“Marine communications mainly based on satellite and narrowband private networks can only support basic voice and simple data services,” concludes Peng Jun of Huawei. “The lack of

ultra-broadband and low-latency networks restricts massive data connections and streamlining, as well as the development of smart ocean. Introducing 5G to smart ocean can help build a marine information highway and enables terrestrial and marine networks to provide the same experience for users.”

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Peng Jun - Director of 5G industry at Huawei



About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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GSMA 5G Transformation Hub

The GSMA 5G Transformation Hub is a source of information on some of the most innovative 5G solutions in the world. This portal contains case studies detailing design, benefits, key players, measured value and the future impact of scaling up these 5G solutions worldwide. The 5G Era is now firmly established and this family of standardised GSM technologies, including mmWave, are being rolled out successfully across the globe. The GSMA 5G Transformation Hub, launched at MWC Barcelona in 2022, provides details of how 5G is best placed to deliver real value for a range of key sectors including manufacturing, energy, transportation, media and live entertainment, smart cities and construction.. Many more case studies will be added, in the coming months, covering even more industries and the GSMA is asking Members to nominate innovative 5G case studies to add to this global digital showcase. The 5G Transformation Hub is sponsored by Qualcomm.

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